

Crop Protection Strategy

Report prepared for
Citrus New Zealand

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Market Access Solutionz Ltd



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1. Background

A crop protection strategy was developed for Citrus NZ in 2023 and updated in February 2025 with accompanying grower crop protection posters for lemon, orange, and mandarin. The February 2025 report identified risks to citrus agrichemical use, identifying compounds that could become unavailable to growers, and identified potential alternatives.

This report is an annual update of agrichemicals used in citrus production, risks to their availability, and potential alternatives.

2. Agrichemical risks update

The agrichemicals used in New Zealand citrus production have been reviewed to identify agrichemicals that are at risk of withdrawal from the NZ market, or where international regulatory changes may restrict their use on export crops.

In addition to New Zealand reassessments, MAS reviewed reassessments in the USA, Australia, the EU, and the Codex Committee on Pesticide Residues (CCPR). The regulatory activities in these markets and CCPR are monitored by the NZ EPA and may influence the NZ reassessment programme. This information was then used to provide an estimate of the risk that an agrichemical may become unavailable for use in citrus (either because of restrictions in New Zealand or in foreign markets). The risk ratings are:

High: Any compounds scheduled for review in New Zealand or compounds scheduled for review in 3 or more overseas countries/Codex.

Medium: Compounds scheduled for review in 2 overseas countries/Codex or approvals withdrawn in an overseas country.

Low: Compounds not scheduled for review, or review is due to a periodic schedule only (i.e., not a risk-based review).

2.1 Changes in Risk Ratings for compounds

Risk ratings are provided in Appendix 1. Since the last report the assessed risk for only two compounds has changed. The risk to the fungicide thiophanate-methyl has been increased to High, to match the risk for carbendazim. Thiophanate-methyl metabolises to carbendazim, which is also the compound analysed in residue tests for both compounds, so the risk is the same for both compounds. In addition, Codex has revoked the Codex MRL for carbendazim on oranges.

The risk rating for the insecticide maldison (malathion) has reduced to Medium, following completion of reviews by the US EPA and Australia's APVMA, which resulted in revocation of some trade name products and label changes. Captan is scheduled for review by the CCPR however as this is a scheduled review, and not a risk-initiated review, the risk rating for captan has not been increased.

2.2 Risks to insecticide use

Seven of the fifteen active ingredient insecticides used on citrus in New Zealand are considered to be at high risk of withdrawal: acephate, bifenthrin, diazinon, fipronil, lambda-cyhalothrin, permethrin, and pirimiphos methyl. Permethrin and pirimiphos-methyl are co-formulated, so if one active ingredient is withdrawn, the co-formulated trade name products will have to be withdrawn.

If these high-risk compounds become unavailable to growers, that leaves 8 active ingredients across 7 resistance management groups.

Australian citrus whitefly

Products used to control Australian citrus whitefly, according to spray diary records and industry information, are buprofezin, spirotetramat, diazinon and pymetrozine. Diazinon is rated as high risk and will be withdrawn from sale and use in NZ in 2028. Diazinon is registered for use only on oranges and mandarins, and it is an offence to use the product off-label.

Pymetrozine is not registered for use on citrus. Pymetrozine is unsuitable for export crops, as there is insufficient data to recommend pre-harvest intervals (PHIs) for most markets. That leaves two products for use on Australian citrus whitefly (buprofezin and spirotetramat).

Citrus flower moth

Products used on citrus flower moth include *B.thuringiensis*, maldison, spinetoram and spirotetramat. It should also be noted that no products have a specific label claim for Citrus flower moth control on citrus, although *B. thuringiensis* is registered for a range of lepidopterous larvae.

Kelly's citrus thrips, greenhouse thrips

The situation appears better for thrips control (Kelly's and Greenhouse), with eight insecticides being used, as well as oils. However three products (acephate, diazinon and fipronil) are considered to be at high risk of withdrawal. Abamectin is not registered for use on citrus. Of the remaining products, spinetoram and spinosad are in the same resistance group, leaving only 5 resistance management groups.

Mealybugs

Apart from Buprofezin (which has no label claim on citrus for mealybug control) and maldison the other products used for mealybug control are all at high risk of withdrawal. This leaves two products for mealybug control.

Scale

The situation is similar for scale control, other than buprofezin, maldison and spirotetramat the other products used for scale control are at high risk of withdrawal.

2.3 Risk to miticide use

Milbemectin, clofentozine and propargite are used for mite control in citrus, as well as oils. Of these, propargite is considered to be at high risk of withdrawal and is scheduled for NZ EPA review in the second half of 2026.

2.4 Risks to fungicide use

Twelve active ingredients used for fungal control in citrus. All the fungicides used on citrus are registered for use on citrus, apart from phosphonic acid. These 12 compounds cover 10 resistance management groups. If the high-risk compounds are removed, this reduces to 7 groups.

The risk to thiophanate-methyl has been increased to High, to match carbendazim. Thiophanate methyl metabolises to carbendazim so they have the same risk profile and are considered as the same compound for this update. Carbendazim/ thiophanate-methyl is the only compound registered as a post-harvest dip for blue mould.

Copper (Medium risk), phosphonic acid (Low risk), mancozeb (High risk), trifloxystrobin (Medium risk) and pyraclostrobin/boscalid (Low risk) (formulated in combination as Pristine) are the main products recorded in spray diaries. None of these are High risk, but it should be noted that trifloxystrobin and pyraclostrobin are in the same resistance management group. Flusilazole (Medium risk) was recorded as being used on satsumas.

Overall, the range of fungicides appears to be narrow, with a reliance on copper and mancozeb, the latter being at high risk of withdrawal. The dependence on trifloxystrobin and pyraclostrobin, which are in the same resistance group, also presents a resistance risk.

3. Recommended crop protection gaps rankings

Citrus New Zealand has provided information to the A Lighter Touch (ALT) programme's gaps and priorities meetings. The priority ranking is presented in Table 1. The ALT assessments for insects are similar to those in this report, although we have assessed the risk to loss of control options for mealybug and scale to be higher than for the ALT programme.

Although there appear to be several fungal control options for citrus, many of these are at risk of withdrawal, and there is a high dependence on a small number of products and modes of action. The relatively low priority assigned to fungicides for the ALT programme should be reviewed, and we do this as part of the report (Section 4 below).

Table 1. Gaps and priorities for A Lighter Touch, and comments from this report.

Pest / disease	Crop	ALT Rank (5=high)	Comment
Citrus Flower Moth	Lemons	4	No products with specific label claims.
Leafroller	All citrus	-	Biological plus 2 low risk group 5 insecticides and 1 group 1B (Medium risk)
Australian citrus whitefly	All citrus	5	Only 1 product with a label claim for ACW on citrus. Three used, 1 high risk and one unsuitable for export.
Kelly's citrus thrips	All citrus	5	Eight products, but 3 at high risk of withdrawal.
Greenhouse thrips	All citrus	4	As above (registrations are for Kelly's)
Lemon tree borer	All citrus	2	Not assessed
Mites	All citrus	-	Limited control options, one high risk.
Mealybug	All citrus	3	High risk of withdrawal of products, leaving 2 actives.
Scale	All citrus	2	Three non high-risk actives available.
Blue mould	All citrus	-	High risk of withdrawal of both actives for PH dip.
Citrus scab	All citrus	3	Narrow range of fungicides, dependence on copper and Mancozeb (high risk). Limited range of modes of action for resistance management.
Melanose, Alternaria, Botrytis	All citrus	3	
Anthracnose	All citrus	3	
Brown rot	All citrus	2	

4. Crop protection gaps

We have updated the assessment of current and future control gaps. This looks at the current status of crop protection products used in New Zealand citrus production, as well as in the future assuming high risk products are no longer available. Priority rankings have been checked in relation to updated risk ratings, and there are no resulting changes.

4.1 Crop protection products for key pest groups

The agrichemicals used for control of key citrus pests are listed in Table 2. At present there are control options available for all key pests, but for Citrus flower moth and fungal diseases the limited number of products / modes of action are of concern for resistance management.

Insect pest control appears to be heavily reliant on high-risk compounds such as organophosphates. All these products are at high risk of withdrawal (including Diazinon phased out by 2028). When these high-risk products are removed (struck-out in Table 2) there is only one product available for mealybug control and Citrus flower moth control.

For all pests and diseases there are fewer than four mode of action groups available when high risk compounds are removed.

Table 2. Key citrus pests, associated crop protection products, and priority ranking (excluding high risk products).

Pest / disease	Active ingredient	IRAC/FRAC Code	Risk	ALT ranking (5=High Priority)	Recommended revised ranking
Australian citrus whitefly	Buprofezin	16	Low	5	5
	Spirotetramat	23	Low		
	Pymetrozine	9B	Medium		
	Oils	NC	Low		
Citrus flower moth	Maldison	1B	Medium	4	5
	<i>B. thuringiensis</i>	BM 02	Low		
	Spinetoram	5	Low		
Leafroller	Maldison	1B	Medium	Not assessed	3
	Spinetoram	5	Low		
	Spinosad	5	Low		
	<i>B. thuringiensis</i>	BM 02	Low		
Thrips (Kelly's, Greenhouse)	Spirotetramat	23	Low	5 KCT, 4 GHT	4
	Maldison	1B	Medium		
	Oils	NC	Low		
	Spinosad	5	Low		
	Spinetoram	5	Low		
	Abamectin	6	Medium		
Mealybug	Buprofezin	16	Low	3	4 5
	Oils	NC	Low		
	Maldison	1B	Medium		
Scale	Buprofezin	16	Low	2	2
	Maldison	1B	Medium		
	Spirotetramat	23	Low		
	Oils	NC	Low		
Mites	Abamectin	6	Medium	Not assessed	2
	Milbemectin	6	Low		
	Clofentezine	10A	Medium		
	Oils	NC	Low		

Pest / disease	Active ingredient	IRAC/FRAC Code	Risk	ALT ranking (5=High Priority)	Recommended revised ranking
Alternaria	Boscalid*	7	Low	3	4
	Pyraclostrobin	11	Medium		
	Copper	M 01	Low		
Anthracnose	Boscalid	7	Low	3	4
	<i>B. amyloliquifaciens</i>	BM 02	Low		
Brown rot	Copper	M 01	Low	2	4
	Captan	M 04	Low		
	Phosphonic acid	P 07	Low		
Botrytis	<i>B. amyloliquifaciens</i>	BM 02	Low	3	4
Citrus scab	Boscalid	7	Low	2	2
	Pyraclostrobin	11	Low		
	Flusilazole	3	Medium		
	Trifloxystrobin	11	Low		
	Copper	M 01	Low		
Melanose	Boscalid	7	Low	3	3
	Pyraclostrobin	11	Low		
	<i>B. amyloliquifaciens</i>	BM 02	Low		
	Copper	M 01	Low		
Blue mould	No products			Not assessed	3↓

Note. Boscalid and Pyraclostrobin are highlighted because they are co-formulated as Pristine® and this should be taken into account in resistance management.

4.2 Updated priority rankings and alternatives

Two changes are proposed to priority rankings for identification of new crop protection products. The ranking of mealybugs reduced from 5 to 4, due to the revision of the risk to maldison. It is recommended that the ranking for Blue mould increases from 1 to 3, due to the increased ranking of thiophanate-methyl to high risk.

Agrichemical trials undertaken by Citrus NZ have been reviewed in the Crop Protection Strategy: Stocktake of agrichemicals assessed by Citrus NZ (Market Access Solutionz, 2024).

Further comments, and alternatives that we are aware of, include:

- **Australian citrus whitefly** – biological controls such as *Encarsia*, ladybirds, lacewing and syrphid (hoverfly). Earlier work was done on the potential for *E. iris* as a BCA. Two synthetic agrichemicals, six biological products, and two physical mode of action products are being trialled against Australian citrus whitefly through the A Lighter Touch programme. We have previously noted that Spidoxamat (Plenexos, Bayer) was launched in 2024 with high mobility on sucking insects (aphids, whiteflies). It is not yet registered in NZ, prioritised for Codex MRLs on citrus but has not yet advanced onto the workplan.
- **Citrus flower moth** – the currently available *B. thuringensis* was not recorded in any spray diaries that we reviewed. However, it is reported to be efficacious in Australia

and South Africa. The insect growth regulator Triflumuron is reported to be effective in South Africa, but is not registered in NZ for horticultural crops.

- **Leafroller** – Spinetoram and Spinosad are both in Group 5. *B. thuringensis* is an available control option not recorded as being used. Methoxyfenozide is an older compound registered in NZ (not on citrus) and is used effectively in other crops in combination with Spinetoram. Tetraniliprole (Vayego®, Bayer) is registered in NZ for leafroller and *Carpophilis* beetle, but not registered on citrus (Codex MRLs for citrus were set in 2023, Group 28).
- **Thrips** – several control options are currently available. Spinetoram and Spinosad are both Group 5, and efficacy confirmed by the results of CNZ research published in NZCGI 126 Sparta efficacy report (2013-2014) (refer also the Agrichemical stocktake report). CNZ is trialling, in conjunction with ALT, three biological and two synthetic agrichemical products for thrips control.
- **Mealybug** – several control options are being used. Spirotetramat (Movento®) is registered for use on citrus (KCT, ACW, scale), but without a claim for mealybug on citrus. It is registered for mealybug control on other crops.
- **Mites** – the acaricide acequinocyl is not registered in New Zealand, but is prioritised for establishment of Codex MRLs, including citrus. Fenpyroximate is registered in NZ for mite control pipfruit, and is at the final stage of establishment of Codex MRLs for mandarins, oranges and satsumas (in addition to existing Codex MRLs for other citrus)
- **Botrytis** – The biological product *B. amyoliquefaciens* is the only product recorded for *Botrytis* control in the spray diaries examined. Fenhexamid (e.g., Teldor®, Bayer) is registered for use on Lemons, Oranges, and Mandarins in NZ for *Botrytis* control, it is FRAC G3, and is at low risk of phase out – but seems to not be used. Florypicoxamid (Adavelit™, Corteva) is not registered in New Zealand, but was recommended in 2024 for establishment of citrus Codex MRLs.
- **Other fungal diseases** – most products for fungal disease control are high or medium risk products, but there is a reasonable range of products available. Mefentrifluconazole (Belanty®, BASF) is registered in New Zealand, but not on citrus. FRAC G1. Codex MRLs for citrus adopted in 2023. Mefentrifluconazole (Cevya®, BASF) is registered on citrus in the USA for control of *Alternaria*, *Anthraco*, Blackspot, Greasy spot, Melanose, Postbloom fruit drop, and Scab.

5. Next steps

CNZ has engaged with the A Lighter Touch Programme to carry out trials on several biological and synthetic agrichemical products for Australian citrus whitefly and Kelly's citrus thrips control. However, the other recommendations for the February 2025 report have not been taken up and progressed. The recommendations noted from this previous report have been reviewed and revised in the context of the updated agrichemicals risks.

CNZ is strongly encouraged to work with agrichemical companies to support the registration of new products on citrus. Based on the risk rankings and ALT priorities, there are several areas where citrus growers are exposed to agrichemical control gaps if high-risk products become unavailable. The following recommendations are initiatives that CNZ can progress alongside the field work being progressed through the ALT programme.

1. Review this updated report and the recommendations for alternative products.
2. Identify areas of greatest need that are not currently being addressed through A Lighter Touch, and where priorities are identified in this report. Examples include:
 - The potential for registration of methoxyfenozide (Corteva) and tetraniliprole (Vayego®, Bayer) for lepidoptera (citrus flower moth and leafroller) on citrus.

- An assessment would need to consider application timing and MRLs for NZ and export.
- The potential for registration of mefenfentrifluconazole (Belanty®, BASF) on citrus. It is already registered in NZ and is registered in USA on a range of citrus fungal diseases.
 - Determine why fenheximid (e.g., Teldor®, Bayer) is not being used by growers for botrytis control on citrus, and whether further grower advisory information (e.g., a Technote) would be appropriate.
3. Approach agrichemical companies with the potential control gaps, and request their suggestions of alternative agrichemical products. Also determine if the companies have plans to register on citrus the products suggested in section 4.2. Depending on the outcome of these discussions, it is likely that CNZ would need to provision financial resources for trial work to support label extensions to citrus.
 4. Repeat the spray diary review (last done on diaries from 2023) to determine whether there have been changes in the products used on citrus, in conjunction with the next annual crop protection strategy update.

6. Appendix 1. Updated citrus crop protection risks sheet

Refer attached Excel spreadsheet.